

## Original Research Article

# Stage-wise analysis of outpatient department patient flow and waiting time at a government tertiary teaching hospital in North India: a mixed-method study

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## ABSTRACT

**Background:** Outpatient department (OPD) waiting time is a recognised indicator of hospital service quality. There are few studies from large Indian government tertiary hospitals combine direct time-motion observation with patient reported timing within a single design. This study measured stage-wise OPD patient flow at a large tertiary teaching hospital in North India to identify the primary contributor(s) to patient delay.

**Methods:** A descriptive, cross-sectional, mixed-method study was conducted from May 2026 to June 2026 among 255 OPD patients selected by convenience sampling. Patient reported timing was used for the arrival to consultation stages, and direct time-motion observation for the pharmacy stage. Data were analysed descriptively, and examined using Pareto analysis and fishbone (Ishikawa) root cause analysis.

**Results:** Mean total patient journey time was 260.4 minutes (arrival to consultation) and 318.6 minutes (arrival to pharmacy completion), of which consultation itself accounted for only 12.8 minutes (under 5% of total time). Waiting time from arrival to being called by the doctor was the primary bottleneck (242.8 minutes; 76.2% relative contribution), followed by pharmacy dispensing time (119.4 minutes; 37.5%). Root cause analysis identified registration-counter misallocation, absence of patient-guidance infrastructure and centralised, multi-stop pharmacy layout as the primary structural causes, rather than clinical staffing or patient volume.

**Conclusions:** OPD delay at this tertiary hospital is driven predominantly by process and layout design rather than from insufficient service points, although staffing and patient volume were not measured here. Target interventions are registration reallocation, patient-guidance infrastructure, digital queue systems, and decentralised dispensing of generic medicines offer a practical, low-resource pathway to measurable improvement.

**Keywords:** Outpatient department, Waiting time, Patient flow, Root cause analysis, Hospital operations, Tertiary care

## INTRODUCTION

Outpatient department (OPD) waiting time is widely used as an indicator of hospital service quality and the World Health Organization has identified it as a marker of overall facility performance.<sup>1</sup> Waiting matters to patients: in an endocrinology OPD in China, actual waiting time was negatively associated with patient satisfaction on several aspects of care.<sup>2</sup> A systematic review of 14

studies covering nearly 70,000 patients found low-to-moderate quality evidence that shorter waits between referral and first visit were linked to better outcomes for specific patient groups, although findings for other outcomes were inconsistent.<sup>3</sup>

In large government tertiary care hospitals in India, OPDs typically serve a very high daily patient volume across multiple specialities, which places considerable pressure

on registration, consultation, and ancillary services such as pharmacy dispensing. A visit is a chain of sequential stages (arrival, registration, token issuance, consultation and for some patients, pharmacy dispensing). Delay at any one of them can extend total time in hospital well beyond the time spent receiving clinical care, affecting patient satisfaction and hospital throughput.

Indian studies show how large the imbalance can be. A prospective study of 80 neurology OPD patients at a tertiary hospital reported a mean waiting time of 110.86 minutes against a mean consultation time of 5.34 minutes.<sup>1</sup> In an armed forces tertiary hospital in northern India, most of 100 patients spent under 30 minutes at registration, but 49% had a consultation longer than 30 minutes, and some waited over 30 minutes at laboratory and radiology.<sup>4</sup> Because an OPD resembles a queueing system, queueing theory has been used to model waiting time and locate bottlenecks. Modelled waiting time fell by roughly 44 to 78 percent after Korean hospitals introduced electronic medical records, and queueing analysis has been applied to the registration stage.<sup>5,6</sup> Without stage-wise measurement, it is not possible to tell whether a long total OPD time reflects a clinical bottleneck (for example, at consultation) or a systemic, non-clinical one (for example, at registration or token processing). In the studies reviewed, most used a single data-collection method for the whole visit and most Indian studies came from smaller settings or single-specialty departments.<sup>1,4</sup>

Objectives of the study is: to analyse patient flow patterns in the OPD across all stages from patient entry through registration, consultation, pharmacy; measure the time spent by patients at each stage of the OPD visit from entry and registration through Pharmacy done across 20 specialty OPDs at government tertiary teaching hospital in North India; identify bottleneck departments and stages through gap analysis; and recommend and suggest specific, prioritised and actionable interventions based on the findings of bottleneck identification, root cause analysis, and data collection.

## METHODS

### *Study design and setting*

A descriptive, cross-sectional, mixed-method study was conducted in the OPD of a large government tertiary care teaching hospital in North India (bed strength 2200+, running 150 multi-specialty OPDs).

### *Study period and population*

Data were collected from May 2026 to June 2026. The study population comprised 255 OPD patients across 20 specialities, selected by convenience sampling.

### *Selection criteria*

Patients attending the OPD during the study period were approached by convenience sampling. Inclusion criteria: patients (of all ages) of any speciality, new or follow-up, attending the OPD during data collection who gave verbal informed consent. In some cases, an attendant answered on behalf of the patient.

### *Exclusion criteria*

Patients who declined consent. No other exclusion criteria were applied. For the pharmacy stage, only patients who collected medicines from the institute pharmacy were observed. Because some patients could not provide a timestamp, each stage-wise analysis includes patients with a valid value for that stage, so the number of patients differs by stage (Table 1).

### *Data collection*

For the stages from arrival through consultation, patients were asked to report specific visit timestamps (arrival, registration, token receipt, and time called by the doctor) via a structured paper questionnaire administered face-to-face and subsequently digitised. For the pharmacy stage, timing was captured through direct researcher observation rather than patient recall, following the time-motion methodology used in an earlier Indian hospital pharmacy study.<sup>7</sup> This hybrid approach reflects that patient-reported timing, while an accepted method in the literature, carries a quantifiable risk of recall bias that increases as the interval between an event and its recall lengthens; direct observation was therefore used specifically at the one stage where continuous researcher presence was feasible.<sup>8</sup>

### *Variables*

Demographic variables (speciality, age, gender, patient type) and stage timestamps were recorded, from which stage-wise waiting-time and total OPD time variables were derived.

### *Data analysis*

Data were analysed descriptively in Microsoft Excel (means, medians, standard deviations). Stage-wise waiting times gap analysis, Pareto analysis, and fishbone (Ishikawa) root cause analysis were used to identify and rank the primary contributor(s) to delay.

### *Ethical considerations*

Formal verbal permission was obtained from Medical Superintendent of hospital. Verbal informed consent was obtained from all participating patients; no patient names or other identifying information were recorded.

## RESULTS

Of the 255 patients studied, 154 (60.4%) were male and 101 (39.6%) females; 207 (81.2%) were follow-up

patients and 48 (18.8%) new patients. Patients were distributed across 20 OPD specialities, with Neurology (15.7%), Nephrology (12.9%), and Cardiology (12.5%) accounting for the largest shares.

**Table 1: Time characteristics of the OPD patient journey (minutes).**

| Indicator                                                      | Valid observations | Mean  | Median |
|----------------------------------------------------------------|--------------------|-------|--------|
| <b>I. Waiting time</b>                                         |                    |       |        |
| Pre-registration waiting time                                  | 61                 | 98    | 63     |
| Effective registration waiting                                 | 61                 | 56.7  | 30     |
| Token received time                                            | 115                | 101.9 | 90     |
| From arrival to doctor called                                  | 132                | 242.8 | 240    |
| From registration to doctor called                             | 31                 | 196.3 | 210    |
| From token received to doctor called (Only Follow-up patients) | 89                 | 156.8 | 150    |
| <b>II. Service Time</b>                                        |                    |       |        |
| Consultation Time                                              | 128                | 12.8  | 10     |
| Pharmacy Time                                                  | 136                | 119.4 | 107    |
| <b>III. Total Patient Journey</b>                              |                    |       |        |
| From arrival to consultation Done                              | 128                | 260.4 | 257    |

Table 1 presents the overall time characteristics of the OPD patient journey. Mean waiting time from arrival to being called by the doctor was 242.8 minutes, substantially exceeding mean consultation time of 12.8

minutes. Mean total patient journey time was 260.4 minutes (arrival to consultation) and 318.6 minutes (arrival to pharmacy completion) meaning under 5% of total visit time was spent in direct clinical consultation.

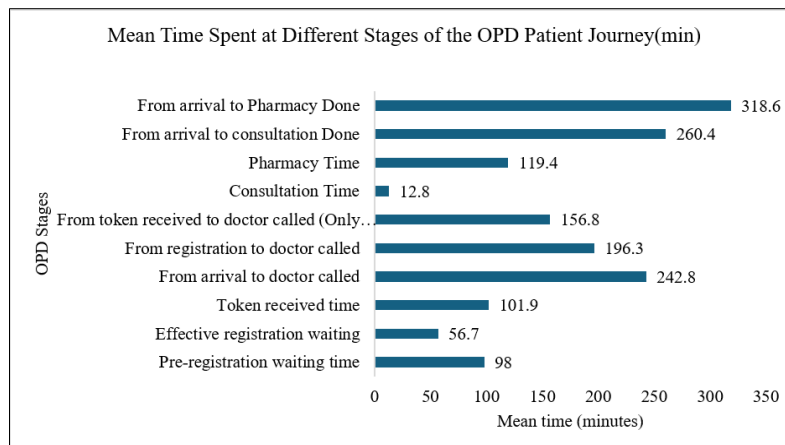


**Figure 1: Mean time spent at different stages of the OPD Patient Journey (minutes).**

**Table 2: Bottleneck ranking of OPD patient journey stages.**

| Stages                                  | Mean (min) | Relative contribution (%) | Priority                  |
|-----------------------------------------|------------|---------------------------|---------------------------|
| Waiting time (arrival to doctor called) | 242.8      | 76.2                      | High-primary bottleneck   |
| Pharmacy time                           | 119.4      | 37.5                      | High-secondary bottleneck |
| Token received waiting time             | 101.9      | 32.0                      | Moderate                  |
| Pre-registration waiting time           | 98.0       | 30.8                      | Moderate                  |
| Effective registration waiting          | 56.7       | 17.8                      | Low                       |
| Consultation time                       | 12.8       | 4.0                       | Low-efficient stage       |

Table 2 presents the bottleneck ranking based on Pareto and gap analysis. Waiting time (arrival to doctor called) was the largest single contributor to cumulative stage time (38.5%), followed by pharmacy time (18.9%); together these two stages accounted for 57.4% of cumulative stage time. Waiting time was classified as the primary, High-priority bottleneck (76.2% relative contribution to total journey time) and pharmacy time as the secondary, High-priority bottleneck (37.5%); consultation time (4.0%) was classified as an efficient stage.

Among specialities with adequate sample size ( $n \geq 10$ ), Nephrology recorded the highest mean waiting time (294.5 minutes,  $n=33$ ) and, together with CVTS, the highest pharmacy dispensing time, indicating compounding delay across both stages for these specialities.

Root cause analysis of the two High-priority bottlenecks, based on direct observation, identified: for the waiting-time bottleneck, misallocation of patient load across the hospital's 13 registration counters, with only 2-3 counters absorbing most patient traffic, and absence of patient-guidance infrastructure; for the pharmacy bottleneck, a fragmented three-stop physical process (billing, payment, and dispensing at separate locations) combined with full centralisation of pharmacy services for all specialities.

## DISCUSSION

The finding that consultation time (12.8 minutes) represented under 5% of total OPD time. The ratio of waiting to consultation time was similar to that reported in a neurology OPD study (110.86 and 5.34 minutes), although the absolute waiting time in the present study was considerably longer.<sup>1</sup> In an armed forces tertiary hospital, by contrast, most patients spent under 30 minutes at registration.<sup>4</sup> These differences may reflect setting, case mix, and measurement method, which this study cannot separate. A heavily front-loaded waiting burden may therefore not be specific to one institution, but this needs confirmation in other large government tertiary hospitals.

The present study's registration-stage findings can be read through a queueing-theory lens: prior work modelling OPD waiting time using arrival and service rates to locate bottlenecks in the consultation process.<sup>5</sup> Queueing analysis has also been applied to the patient registration stage as a distinct, measurable step.<sup>6</sup> The observation that only 2-3 of 13 registration counters absorbed most patient traffic, while the remainder ran near-empty, is consistent with a queueing imbalance rather than a shortage of total capacity. A comparable pattern a reception points unable to process a category of registration, forcing overflow elsewhere was identified as a root cause of OPD delay at a large private tertiary hospital in Hyderabad, India, where introducing patient care coordinators to guide misdirected patients was implemented as a direct fix.<sup>9</sup>

The pharmacy-stage findings parallel an earlier Indian hospital pharmacy time-motion study, which found the largest delay was driven not by patient volume but by an internal process step the interval between medicine collection and dispatch.<sup>7</sup> The present study's pharmacy observations follow the same underlying logic: delay is driven by a fragmented, multi-stop physical process and full centralisation, not insufficient total service points. In both studies, the practical implication is the same adding staff or counters would not resolve a delay caused by process and layout design.

Based on these root causes, this study recommends dynamic reallocation of registration counters to match observed demand; introduction of patient-guidance infrastructure and personnel, consistent with evidence that absence of guidance is a specific, citable cause of prolonged OPD waiting; digital, department-level queue-display systems, consistent with technical interventions shown to contribute to a 45% reduction in OPD waiting time at a tertiary hospital in Tanzania; and decentralisation of generic-medicine dispensing to department-level satellite counters, retaining the central pharmacy only for complex prescriptions.<sup>10,11</sup> This last recommendation is the study's own proposal and was not tested here; its feasibility should be evaluated before adoption.

These findings can additionally be positioned within the balanced scorecard's internal business process perspective, under which process-level measures such as timeliness of care delivery and resource utilisation are treated as a legitimate, standalone hospital performance dimension, distinct from clinical care quality.<sup>12</sup> This framing supports treating OPD time efficiency as a management priority in its own right, independent of the finding that clinical consultation itself was efficient.

## Limitations

Self-reported timestamps are subject to recall bias.<sup>8</sup> Where attendants answered on behalf of patients, timestamps may carry additional recall error. Convenience sampling limits generalisability. Data completeness varied by stage, and several specialities had small sample sizes, limiting the reliability of speciality-level comparisons. Staffing and patient volume were not measured. Root causes were based on direct researcher observation rather than a formal departmental audit, and should be treated as a strong diagnostic starting point rather than an exhaustive causal inventory.

## CONCLUSION

OPD delay at this tertiary hospital was found to be driven predominantly by registration and pharmacy process design rather than from insufficient service points, although staffing and patient volume were not measured here. Targeted, low-resource interventions - counter reallocation, patient guidance, digital queue visibility, and

decentralised generic-medicine dispensing offer a practical pathway to measurable improvement without requiring major additional clinical capacity.

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